

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

TSN2101 – OPERATING SYSTEMS
(All Sections /Groups)

14 MARCH 2020
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question Paper consists of 4 pages with 4 Questions only.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

QUESTION 1

- a) System calls are typically implemented in the form of software interrupts for requests to access the operating system's services. How do the interrupts facilitate these requests? [3 marks]
- b) Interprocess communication can be achieved through message passing or shared memory. Contrast between the two methods. [2 marks]
- c) Processes may create other processes through appropriate system calls. The process which does the creating is termed the parent of the other process, which is termed its child. After creating the child, what are the options available to the parent in terms of execution? [4 marks]
- d) There are two types of threads to be managed in system - user threads and kernel threads. State two differences between user and kernel threads. [2 marks]
- e) Whenever the CPU becomes idle, the scheduler will select another process from the ready queue to run next. CPU scheduling decisions take place under one of four conditions. State the four conditions. [4 marks]

Continued...

QUESTION 2

a) Consider the following set of processes:

| Process | Arrival time | Burst-time | Priority |
|---------|--------------|------------|----------|
| P1 | 2 | 2 | 1 |
| P2 | 4 | 6 | 2 |
| P3 | 0 | 4 | 3 |
| P4 | 6 | 4 | 5 |
| P5 | 5 | 8 | 4 |

i) Draw the Gantt charts illustrating the execution of these processes using Pre-emptive Priority (a smaller priority number implies a higher priority), and Round Robin (RR) (quantum = 2) scheduling.

[2 + 2 = 4 marks]

ii) Calculate the average turnaround times for the Pre-emptive Priority and RR algorithms?

[1 mark]

iii) What are the average waiting times for the Pre-emptive Priority and RR algorithm?

[1 mark]

b) In process synchronization, a problem with semaphores is the busy loop in the wait call, which consumes CPU cycles without doing any useful work. Suggest an alternative approach to this.

[3 marks]

c) Consider the following system with FIVE processes and THREE resource types:

- A has 10 instances
- B has 10 instances
- C has 10 instances

The snapshot of the system is given as:

| Process | Allocation | | | Max | | | Available |
|---------|------------|---|---|-----|----|---|-----------|
| | A | B | C | A | B | C | |
| P1 | 2 | 2 | 2 | 6 | 10 | 8 | 2 |
| P2 | 2 | 0 | 2 | 2 | 4 | 4 | 2 |
| P3 | 0 | 2 | 2 | 6 | 6 | 6 | 2 |
| P4 | 2 | 2 | 0 | 6 | 8 | 6 | 2 |
| P5 | 2 | 2 | 2 | 4 | 2 | 4 | 2 |

Answer the following questions using the Banker's algorithm:

i) What is the content of the matrix *Need*?

[2.5 marks]

ii) Find a sequence of processes that will get the system into a safe state, if there is any. Show all required steps.

[3.5 marks]

Continued...

QUESTION 3

a) For a two-level page table, if reference to the translation look-aside buffer (TLB) takes 50 nanoseconds, and memory reference takes 150 nanoseconds, identify the hit ratio to achieve an effective access time of 400 nanoseconds.

[2 marks]

b) Consider the following page table in a demand paging system. Assume a system page size of 2 KB (1 KB = 1024).

| Frame | Valid-Invalid bit |
|-------|-------------------|
| 4 | v |
| 2 | i |
| 6 | i |
| 8 | v |

Check whether the following logical addresses results in addressing error and trap to operating system. If it does not result in addressing error, identify the corresponding physical address.

- i) 7230
- ii) 5213
- iii) 100
- iv) 6125

[0.5 + 0.5 + 0.5 + 0.5 = 2 marks]

c) Consider a system that uses a three-level page table with page size of 2 KB and 64-bit logical addresses. The system supports 2 GB of physical memory. How many entries are there in each of the following?

- i) A conventional single-level page table
- ii) An inverted page table

[1 + 1 = 2 marks]

d) On a multi-user system, more information is needed to be stored for the management of files. List THREE of the possible information stored.

[3 marks]

e) Suppose that a disk drive has 2000 cylinders, numbered from 0 to 1999. The drive is currently serving a request at cylinder 400, and the previous request was at cylinder 500. The queue of pending requests, in FIFO order, is

600, 1200, 800, 1600, 1000, 1400, 200, 1800, 300

Starting from the current head position, what is the schedule and the total distance that the disk arm moves to satisfy all the pending requests, for each of the SCAN and LOOK disk-scheduling algorithms?

[3 + 3 = 6 marks]

Continued...

QUESTION 4

a) Consider the following page reference string:

4 2 6 8 4 6 2 2 4 6

Assume the availability of THREE frames and all the frames are initially empty. Consider the First-In-First Out (FIFO), Least Recently Used (LRU) and Optimal (OPT) page replacement algorithms for virtual-memory management. Show the states of the frames if these algorithms are used.

[2 + 2 + 2 = 6 marks]

b) Assume the following a system with eight frames:

| Page number | Load Time | Last Reference Time | Modify Bit | Reference bit |
|-------------|-----------|---------------------|------------|---------------|
| 0 | 10 | 700 | 0 | 1 |
| 1 | 40 | 300 | 1 | 1 |
| 2 | 20 | 500 | 0 | 1 |
| 3 | 50 | 200 | 1 | 1 |
| 4 | 80 | 400 | 1 | 0 |
| 5 | 60 | 900 | 1 | 1 |
| 6 | 90 | 800 | 0 | 1 |
| 7 | 70 | 600 | 1 | 1 |
| 8 | 30 | 100 | 0 | 1 |

Identify the victim (page to be replaced) for the following algorithms.

- i) First-In-First-Out (FIFO)
- ii) Least-Recently-Used (LRU)
- iii) Reference bit – Modify bit combination (Assume modify bit is having higher priority over reference bit and FIFO is used in the case of tie)
- iv) Second Chance

[1 + 1 + 1 + 1 = 4 marks]

c) Using linked allocation to store files on disk, there exists certain limitations to this technique. Provide THREE of these limitations.

[3 marks]

d) In Linux, symbolic links are used to link directories and/or files in filesystems. If the original directory or file is moved or deleted, suggest what can be done to fix the symbolic link.

[2 marks]

End of Page.